

**Strategies for Oil and Gas Companies to Remain Competitive in the
Coming Decades of Energy Challenges**

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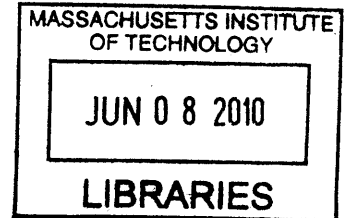
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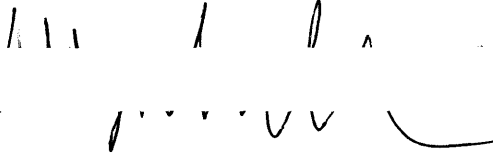
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ABSTRACT

There are a variety of challenges facing the energy industry, from decreased access to sovereign reserves, to declining fields, innovation challenges, increased regulation and new energy policies. These challenges pose a threat to the basic industry structure. Oil & gas companies espouse four common industry-wide strategies of Portfolio Management, Operational Efficiency, Financial Management and Sustainability—of which the first three are core operating strategies of oil & gas companies. The companies have derived their profitability, growth, and shareholder returns based on the superior execution of these strategies. Though talk about Sustainability is a business imperative, it is no longer a differentiating factor and is not integrated with the core strategies. The current challenges facing the energy industry, however, necessitate that the companies integrate sustainability, innovation and management of technology strategies with their core strategies of portfolio management, operational efficiency and financial management.

In this thesis, we propose two distinct strategic options: *Total Life Cycle Management* and *Management of Technology*. Environmental management and organizational efficiency are an integral component of both the strategic options. Through Total Life Cycle Management, the companies address challenges of continued access to easier to develop and produce reserves and legacy fields, efficiencies, costs and hosts expectations. The key components of Total Life Cycle Management constitute Portfolio Management with enhanced relational strategies with the hosts, Operational Efficiency with continuous business process innovations, Sustainability with focus on long-term energy needs of the hosts and Financial Management with focused capital allocation to build scale and synergies in a region. Management of Technology strategies address the innovation challenges to tap the next big reserves in ultra deepwater, arctic, unconventional hydrocarbons, etc. These strategies will provide differentiation on capabilities to better identify, develop, and deploy technologies. Key components of the Management of Technology strategy include R&D strategy, innovation fronts, organizational efficiency and operational performance. Companies can position themselves either as a cost- and efficiency-driven company, or as a technology-driven company—or both provided they have different organizations managing the two distinct options. The industry needs new performance metrics to reflect company performance *vis a vis* the variety of energy industry challenges.

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Executive Summary

How will the International Oil Companies (IOC's) need to strategically position themselves in the coming decades of:

- Continued increase in the power of resource owners and increasing difficulty gaining access to resources?
- Innovation challenges to produce the hard-to-develop reserves in deepwater, arctic, unconventional hydrocarbons, etc.?
- Continued increase in energy demand?
- New energy policies with carbon pricing?
- Increased oversight and regulations from the governments?
- Greater concerns in the society about global warming?
- Negative perceptions of 'Big Oil'?

How will the International Oil Companies (IOC's) need to redefine themselves, and their strategies to continue to create value for their shareholders, and society at large?

Can the IOC's continue to strategically position themselves based on a narrow Portfolio Management (PM), Operational Efficiency (OE), Financial Management (FM)-driven business model in this new external environment? Will Portfolio Management, Operational Efficiency and Sustainability with-in Total Life Cycle Management Strategy, and Management of Innovation and Technology-driven business models be a business imperative to continue to grow and create long term value for the share holders and society?

In this thesis we have tried to answer some of these fundamental questions that might alter the basic structure of the energy industry going forward. In the process, we have developed new strategies for oil & gas companies to remain competitive in the coming

decades of energy challenges. These new strategies will not only help the industry, but also the society at large as it deals with the same set of challenges.

Introduction

The strategic commodity

As the dominant source to meet the world's energy needs for the better part of the last sixty years, crude oil has held more influence over the politics and economic strategies of nations than any other commodity—frequently proving the source of instability, dispute and war. From the birth of Standard Oil through the expropriation of Yukos, the oil industry has similarly found itself the subject of frequent controversy, with the companies involved often achieving profits and wielding power greater than the nations in which they are based. For an industry that, at its most basic involves little more than drilling a hole in the ground in the hope of finding the "black stuff", the modern day oil industry is a remarkable amalgam of politics, economics, science and technology.

The Oil & Gas Industry is comprised of companies that have a history that is longer than that of several modern day countries. Governments may come and go and wars may pass—yet in pursuit of that life-giving incremental barrel of reserves, the major oil companies have evolved into the industrial behemoths that stand today¹, and the question is: ***Will they still be standing tomorrow?***

¹ (Deutsche Bank, 2008)

Challenges for the energy industry

Oil and Gas Industry is facing an exciting, complex, and uncharted landscape. Few industries today face greater economic, technical, geographic, and operational opportunities and challenges.

Growing global demand for energy coupled with a tight worldwide supply of crude and hydrocarbon products will likely mean price volatility going forward, despite the current recession. At the same time, the industry faces the rapid decline of mature assets. It is estimated that more than 80% of the world's producing assets are past peak production and in rapid decline.

The International Energy Agency estimates significant growth in energy demand over the next 25 years. Between now and 2030, world primary energy demand is estimated to expand by 45%—an average growth rate of 1.6% per year and one that will be overwhelmingly supplied by oil.

To meet this demand, oil & gas companies have to enhance their portfolio management and operational efficiency strategies, as well as increase focus on R&D, innovation and management of technology to maximize recovery, development, and production efficiency. The oil & gas industry has to push into new geographic, geologic, and technical frontiers such as Ultra deepwater, Arctic, Unconventional hydrocarbons, etc.

Some of the other critical new issues facing the industry today include developing cleaner-burning fuels, environmental friendliness, and CO₂ abatement².

The challenges for the energy industry can be summarized as follows in order of severity:

² (Singh, 2009)

1. Fields decline

2. Access to reserves—continued increase in power of resource owners & National Oil

Companies (NOC's)

3. Management of technological Innovation

- Enhanced Oil Recovery
- Innovation challenges in hard to produce reserves such as
 - Deepwater/Subsea
 - Unconventional Hydrocarbons etc.

4. Policies

- New Energy Policies such as carbon pricing
- Increased Regulations
- Greater concerns in the society about global warming

5. Supply/Demand Dynamics

- Continued increase in energy demand

The order of severity is based on an in-depth review of the industry landscape and interviews with oil & gas industry professionals.

Threat to the Oil & Gas Industry Structure

When we analyze the elements of the Oil & Gas industry structure using Porter's Five-Forces

Model, the overall attractiveness of the industry is low.³ Briefly:

- Bargaining power with suppliers—highly unattractive
 - Reserves held by sovereign nations
 - Access to reserves becoming increasingly difficult
 - Security of supply
 - Small surge cushion
 - Dwindling OECD reserves shifts power to host nations
- Barrier to entry—very attractive
 - Capital intensive
 - Cyclical, price volatility due to supply/demand dynamics
 - Era of easy oil over; newer reserves more difficult and expensive to extract
 - New fronts require innovative leading-edge technologies
 - High barriers for new entrants
 - Host nations already have NOC's
- Bargaining power with buyers—highly unattractive
 - Negative buyer perception of "big oil"
 - Greater concern in society about global warming, i.e. GHG emissions
 - Soaring pump prices attract undesired attention
- Threat of substitutes—mildly unattractive
 - Alternative energy

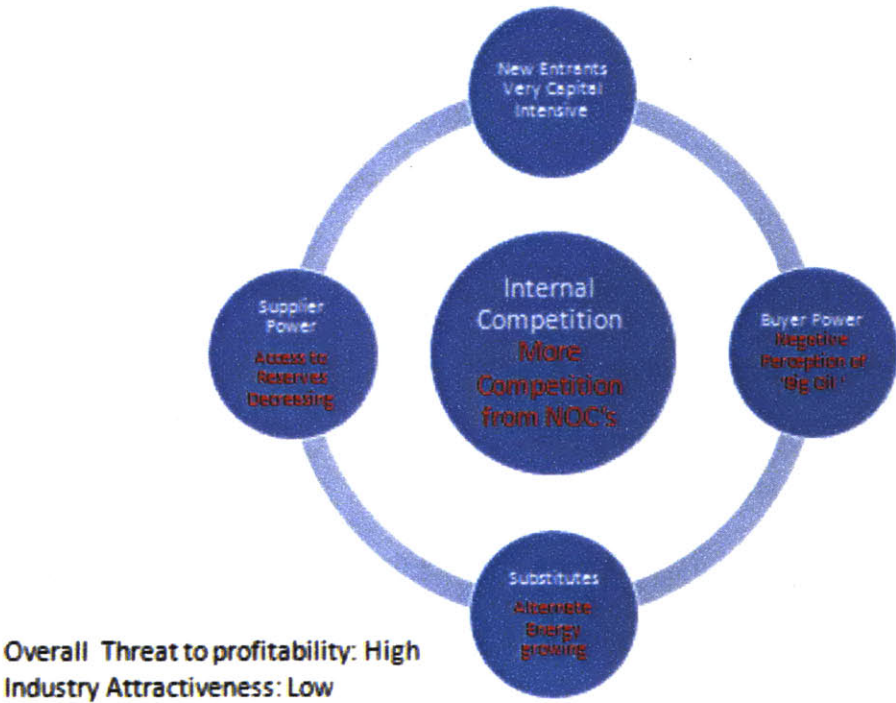
³ Deutsche Bank, *Oil & Gas for Beginners*, (Deutsche Bank, 2008).

- Carbon pricing, energy policy
- New regulations
- Internal competition—highly unattractive
 - Mega-mergers left fewer IOC players but more competition from NOC's
 - Limited availability of reserves
 - Reserves available in challenging environments

Per Porter's framework for summary assessment of the industry, attractiveness of the industry is low. OECD mega-fields have started to decline, and strong emerging market demand growth has handed yet more power to the major resource holders in the Middle East, Africa, Russia and Venezuela. Increased terrorism activities have put oil infrastructure at heightened risk—and geopolitical stability in the Middle East has fallen in the aftermath of Gulf War II and with the emergence of Iranian nuclear ambitions. Correspondingly, the oil prices are very volatile and rose by almost a factor of five in 2007/2008. In addition, resource holders have raised both taxes and National Oil Companies (NOC) stakes at the expense of IOCs. Supplier power is thus high, competition for new acreage or M&A deals from NOCs is also high, the high pump prices raise consumer discontent and even the green movement is gathering momentum. All in all the threats to profitability of IOCs are high relative to previous eras and hence industry attractiveness is low⁴. This is illustrated in Figure 1.

⁴ (Deutsche Bank, 2008)

Figure 1: Threat to Industry Structure



Current Industry Landscape

A subset of twelve Oil & Gas Companies was studied to understand the current industry landscape. The selection of companies was based on:

- Market capitalization
- Classification type, i.e. US Independents, International Independents, US Integrated and International Integrated
- Diversity in geographic regions of origination such as Canada, U.K. and Australia

The companies chosen for the study included:

US Independent Oil & Gas Companies

- Apache Corporation (Market Cap \$ US Bil. 34.7)
- Occidental Petroleum Corporation (Market Cap \$ US Bil. 66)
- Anadarko (Market Cap \$ US Bil. 30.7)

US Integrated Oil & Gas Companies

- Exxon Mobil (Market Cap \$ US Bil. 323 Billion)
- ConocoPhillips (Market Cap \$ US Bil. 75)
- Chevron (Market Cap \$ US Bil. 154)

International Independent Oil & Gas Companies

- Woodside (Market Cap \$ US Bil. 31.7)
- Talisman Energy Inc. (Market Cap \$ Can Bil. 18.3)
- Tullow Oil plc (Market Cap British Pound Bil. 10.35)

International Integrated Oil & Gas Companies

- Shell (Market Cap \$ US Bil. 186)
- BP (Market Cap \$ US Bil. 181)
- TOTAL (Market Cap \$ US Bil. 151)

Objectives of the study

The objectives of choosing this subset from a wide spectrum of oil & gas companies are to:

- Understand how the oil & gas companies define themselves
- Analyze their key strategies
- Review their key reported performance metrics both
 - Quantitative—i.e. production, reserves, financial, environmental, etc.
 - Qualitative—i.e. values, spirit, community development, etc.
- General strategic similarities
- Strategic differentiation if any
- Future Positioning strategies if any

Expected outcome from the study

The purpose of the study is to:

- Develop a good sense of the broader industry strategies and current landscape, and to use this specific understanding to theorize recommendations on where the industry needs to be in order to remain competitive in the changing landscape.
- Perform a gap analysis between the industry strategies and challenges for the energy industry.

How do the oil & gas companies define themselves?

Following are quotes from the websites of the companies studied:

XX's Upstream segment aims at continuing to combine long-term growth and profitability at the levels of the best in the industry. XX evaluates exploration opportunities based on a variety of geological, technical, political and economic factors (including taxes and license terms), and on projected oil and gas prices.⁵

XX uses its pioneering spirit to responsibly deliver energy to the world. This purpose transcends all of XX's operations. The company conducts its business to return maximum value to shareholders while utilizing a wealth of knowledge and resources from its employees and acting responsibly in all communities in which it operates.⁶

The company understands its responsibility to deliver energy in a safe, environmentally and socially responsible manner. XX is known worldwide for its technological expertise in reservoir management and exploration, 3-D Seismic technology, high-grade petroleum coke upgrading and sulfur removal.⁷

XX's mission is to deliver a competitive and sustainable rate of return to shareholders by developing, acquiring and exploring for oil and gas resources vital to the world's health and welfare.⁸

Providing energy that helps underpin growing economies and improve living standards around the world.⁹

To help meet the world's growing energy needs, XX is involved in the exploration and production of crude oil and natural gas; the manufacture of petroleum products; and the transportation and sale of crude oil, natural gas, and petroleum products. We are a major manufacturer and marketer of commodity and specialty petrochemicals and have interests in electric power generation facilities. Our extensive research programs support operations, enable continuous improvement in each of these businesses, and explore emerging energy sources and technologies.¹⁰

⁵ (TOTAL, 2010)

⁶ (ConocoPhillips, 2010)

⁷ (ConocoPhillips, 2010)

⁸ (Anadarko, 2010)

⁹ (ExxonMobil, 2010)

¹⁰ (ExxonMobil, 2010)

*XX is committed to respecting the environment, maintaining safety and upholding high standards of social responsibility throughout the company's worldwide operations. XX's success is built on technical expertise, business acumen, strong partnerships and proven ability to deliver superior results.*¹¹

*XX is a global, diversified, upstream oil and gas company, headquartered in YY. XX's three main operating areas are North America, the North Sea and Southeast Asia. The Company also has a portfolio of international exploration opportunities.*¹²

*XX is committed to conducting business safely, in a socially and environmentally responsible manner, and is included in the Dow Jones Sustainability (North America) Index. XX is listed on the YY and ZZ Stock Exchanges under the symbol XX.*¹³

*We are a global group of energy and petrochemicals companies with around 101,000 employees in more than 90 countries and territories. Our innovative approach ensures we are ready to help tackle the challenges of the new energy future. Our strategy seeks to reinforce our position as a leader in the oil and gas industry in order to provide a competitive shareholder return while helping to meet global energy demand in a responsible way*¹⁴.

*In Upstream we focus on exploring for new oil and gas reserves and developing major projects where our technology and know-how adds value to the resource holders.*¹⁵

*XX operates at the frontiers of the energy industry. We use world-class assets, technology, capability and know-how to meet energy needs and deliver long-term value. Find out how a revitalized XX is driving efficiency, momentum and growth.*¹⁶

So, how do the oil & gas companies define themselves? There is very little to no differentiation in how the companies define themselves. The oil & gas companies define themselves as: Global, Diversified, Delivering energy to the world, Profitable, Providing maximum value to shareholders, Providing competitive and sustainable rate of return to

¹¹ (Oxy, 2010)

¹² (TALISMAN ENERGY, 2010)

¹³ (TALISMAN ENERGY, 2010)

¹⁴ (Shell, 2010)

¹⁵ (Shell, 2010)

¹⁶ (BP, 2010)

shareholders, and Conducting business safely, in a socially and environmentally responsible manner. A few mention technical expertise, and *only one* mentions innovation.

Key Industry Strategies

Based on the companies studied, the industry strategies can be classified into two types: the common industry-wide non differentiating strategies which all oil & gas companies follow, and the differentiating strategies unique to a few oil & gas companies. All of the oil & gas companies studied espouse four common industry-wide strategies. These are:

- Portfolio Management (PM)
- Operational Efficiency (OE)
- Financial Management (FM)
- Sustainability (S)

In the following sections we dissect these common industry wide strategies to understand what they actually mean.

Portfolio Management (PM) Strategies

Following are some of the key PM strategies followed by the oil & gas companies:

- **A balanced portfolio of assets**
 - Diversity of geologic and geographic risk
 - No single region contributing more than a certain percentage of production or reserves
 - Multiple geological locations providing a mixture in reserve life, which translates into a balance in the timing of returns on investments
- **A balanced mix of hydrocarbons (oil & gas)**
 - Providing some measure of protection against price deterioration in a given product while retaining upside potential through a significant increase in either commodity price.
- **Portfolio of core areas**
 - Providing long-term growth opportunities through drilling supplemented by strategic acquisitions
- **Critical mass in each of the producing regions**
 - Supporting lower-risk, repeatable drilling opportunities
 - Allowing pursuit of higher-risk, higher-reward exploration opportunities in other regions

Following are quotes from the websites and annual reports of the oil & gas companies studied on portfolio management:

No single region contributed more than 23 percent of our production or reserves in 2008. Our multiple geological locations also provide us a mixture in reserve life, which translates into balance in the timing of returns on our investments. Reserve life

(estimated reserves divided by annual production) in our regions ranges from as short as seven years to as long as 27 years.¹⁷

In 2008, crude oil and liquids provided 50 percent of our production and 68 percent of our revenue. We were well-positioned to realize the benefit of higher oil prices, which significantly outpaced natural gas price increases for much of the year, despite falling 70 percent from their June 2008 peak. Our year-end estimated proved reserves were balanced at 55 percent natural gas and 45 percent crude oil and liquids¹⁸

“Our average daily production of liquids and natural gas was 2.34 million barrels of oil equivalent in 2008. Liquids accounted for approximately 62% and natural gas accounted for approximately 38% of X’s combined production of liquids and gas in 2008 on an oil equivalent basis. We will leverage a solid and diversified portfolio of proved reserves of 10.5 billion barrels of oil equivalent and proved and probable reserves of 20 billion barrels of oil equivalent as of end-2008.¹⁹

¹⁷ (Apache CORPORATION, 2010)

¹⁸ (Apache CORPORATION, 2010)

¹⁹ (TOTAL, 2010)

Operational Efficiency (OE) strategies

OE strategies are cost-driven. They include overall life cycle cost efficiencies in finding, development, lifting, technical and corporate costs:

- **Strategies to increase reserves while controlling costs of finding**
- **Strategies to increase production while controlling costs of development**
- **Strategies to sustain production while controlling costs of operations**

Following are quotes from the websites and annual reports of the oil and gas companies studied on operational efficiency.

*Continuous improvements in operating performance, with an emphasis on safety, asset performance and operating costs, including firm plans for \$1 billion of cost savings in 2010, and staff reduction of some 2,000 positions by end-2011.*²⁰

*XX's strategy is centered on strong operating performance and sustained investment for organic growth. That strategy is robust, despite the difficult economic environment. But the company had become too complicated and slower to respond than we'd like. So we are sharpening up. The priorities are for a more competitive performance, for growth, and for sharper delivery of strategy. We have more to do to drive out cost and improve the operating performance in the company.*²¹

*Within an organization of our scale, putting a long-term commitment to efficiency at the heart of the group is essential to improving earnings, year after year. Our challenge is to maintain a relentless focus on continuous improvement, making today better than yesterday, so that we continue to drive the business forward whatever the market conditions.*²²

²⁰ (Shell, 2010)

²¹ (Shell, 2010)

²² (BP, 2010)

Financial Management (FM) Strategies

Financial Management (FM) strategies of the oil and gas include:

- **Maintaining financial flexibility**, while maximizing earnings and cash flows by controlling costs
- **Growing the business** through sustained capital expenses (CAPEX)
- **High shareholder return** through dividends and share buy backs
- **Maintaining a healthy balance sheet** such as low debt to equity ratio

Following are quotes from the websites and annual reports of oil and gas companies studied on overall financial management strategy:

*Our strategy includes building a balanced portfolio of assets, maintaining financial flexibility, and maximizing earnings and cash flows by controlling costs.*²³

*Preserving financial flexibility and a strong balance sheet are also key to our overall business philosophy.*²⁴

*...maximization of earnings and cash flow. Both are significantly impacted by commodity prices, which fluctuate and are primarily influenced by factors beyond our control, including worldwide supply and demand, political stability and governmental actions and regulations.*²⁵

²³ (Apache CORPORATION, 2010)

²⁴ (Apache CORPORATION, 2010)

²⁵ (Apache CORPORATION, 2010)

Sustainability (S) Strategies

Some of the common corporate social and environmental responsibility strategies of the oil and gas companies include:

- **Employees and Community strategies²⁶:**
 - Uphold and advocate for fundamental human rights in host countries and communities
 - Ensure the safety of employees and people living and working near facilities
 - Implement human resources policies based on fairness, diversity and employee dialogue
 - Respect neighboring communities and spur their development
 - Promote transparent revenue flows for host countries
- **Climate Change strategies²⁷**
 - Reduce greenhouse gas emissions
 - Devise new solutions such as carbon capture and storage
 - Improve energy efficiency of processes
 - Help customers use energy more efficiently
- **Environmental Strategies²⁸:**
 - Limit the impact of operations and related transportation on air, water and soil quality
 - Protect biodiversity

Following are quotes from the websites and annual reports of the oil & gas companies studied on sustainability strategies:

²⁶ (TOTAL, 2010)

²⁷ (TOTAL, 2010)

²⁸ (TOTAL, 2010)

Tracking our performance against a range of environmental and social indicators helps us to focus our efforts to improve into the future. We participate in the Carbon Disclosure Project and are included in the Dow Jones Sustainability Index and the FTSE4Good Index.²⁹

\$1.7 billion spent on CO₂ and renewable energy technologies over the last 5 years. In 2008 greenhouse gas emissions from facilities where we operate were approximately 30% below 1990 levels. \$19 billion spent in 2008 with locally owned companies in low and middle income countries. \$148 million on social investment programmes in 2008.³⁰

The objectives of the XX are to engage safely, responsibly, efficiently and profitably in oil, gas, oil products, chemicals and other selected businesses and to participate in the search for and development of other sources of energy to meet evolving customer needs and the world's growing demand for energy. We believe that oil and gas will be integral to the global energy needs for economic development for many decades to come. Our role is to ensure that we extract and deliver them in environmentally and socially responsible ways, safely and profitably. We seek a high standard of performance, maintaining a strong long-term and growing position in the competitive environments in which we choose to operate. We aim to work closely with our stakeholders to advance more efficient and sustainable use of energy and natural resources.³¹

Portfolio Management (PM), Operational Efficiency (OE) and Financial Management (FM) are core non-differentiating strategies of oil & gas companies. The companies derive their profitability, growth, and shareholder returns based on the execution of these strategies. Obviously, some perform them better than the others, with better financial results such as higher revenues, earnings and free cash flows.

Sustainability strategies are no longer a differentiating factor. To at least talk about sustainability is more of a business imperative than a choice. Currently the talk about sustainability is more driven by regulations, political and social pressures than business

²⁹ (Shell, 2010)

³⁰ (Shell, 2010)

³¹ (Shell, 2010)

needs. Some companies have more evolved sustainability strategies than others—but currently, for most oil & gas companies studied, sustainability strategies are not integrated with the core PM, OE, and FM strategies.

Unique Differentiating Strategies

A few of the oil & gas companies studied are seeking to differentiate themselves on strategies such as:

- **Asset based leadership**
- **Enhanced Oil Recovery (EOR)**
- **Development of hard-to-produce reserves**, such as ultra-deep offshore resources, high-pressure/ high-temperature fields, sour gas, etc.
- **Evolved sustainability strategies**

These companies are executing these strategies in addition to the common industry-wide strategies of Portfolio Management, Operational Efficiency, Financial Management and Sustainability (PM, OE, FM, S). In the following sections we illustrate these differentiating strategies as executed by these companies.

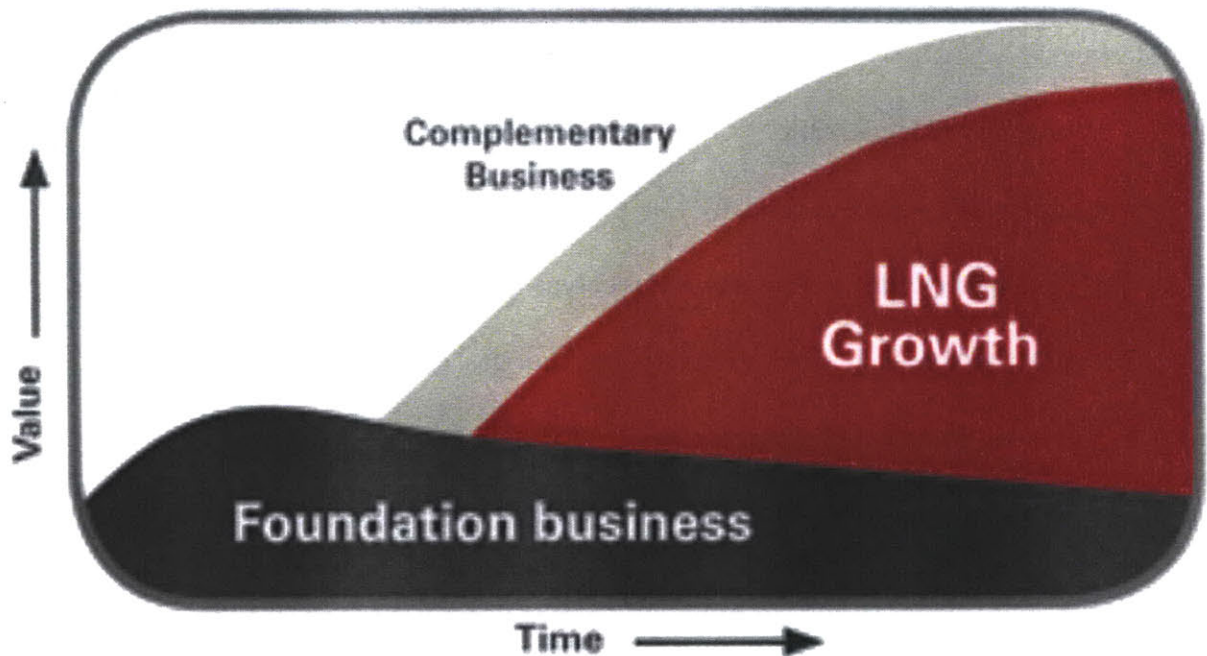
Asset based differentiation³²

Woodside is differentiating itself by positioning to be a Global Leader in Liquefied Natural Gas (LNG) production. Woodside's goal is to be a global leader in LNG production by 2015, when global demand for LNG is expected to exceed supply. In 2010, Woodside will complete construction of its \$12 billion Pluto LNG Project near Karratha, Australia's second biggest resources project. They are also progressing their Sunrise and Browse LNG developments.

Their vision for Asset Based Differentiation based on dominance of LNG in their resource portfolio is demonstrated on the *Asset Value versus Time Plot* (Figure 2). The plot illustrates that, going forward, LNG will bring in a dominant share of their total portfolio value.

³² (Woodside, 2010)

Figure 2: Woodside's Asset Value versus Time Plot



Woodside has also aligned its logo to reflect its differentiating corporate strategy. On 4 February 2009, Woodside unveiled a change to its logo, designed to place greater emphasis on the future of its liquefied natural gas business while continuing to acknowledge foundation oil and gas projects. It is the fourth version of Woodside's logo in the 55-year history of the company, and the first substantial change in 32 years.

The changed logo better acknowledges Woodside's emergence as a global leader in liquefied natural gas. It is intended to convey a clean, modern image, while continuing to acknowledge the past and recognize the foundation projects that will support Woodside's future growth. The new logo is comprised of three ellipses that come together to form a "W". The three ellipses also symbolise a flame. The centre ellipse, slightly fattened, is coloured sandstone and represents a hydrocarbon reservoir. The colour of the left ellipse is foundation grey and represents Woodside base business, including its oil assets. This ellipse supports the logo in the same way these foundation businesses will support Woodside's

future growth. The colour of the right ellipse is Woodside red, and this represents the company's gas business going forward (Figure).

From late 2010, when the Pluto LNG Development is scheduled to begin production, natural gas will dominate Woodside's production portfolio.

Figure 3: Woodside Logo



Enhanced Oil Recovery (EOR) based differentiation³³

Occidental Petroleum Corporation (Oxy) is differentiating itself on Enhanced Oil Recovery (EOR). They identify themselves as a worldwide leader in applying advanced technology to boost production from mature oil and natural gas fields.

In both domestic and international operations, Oxy is an acknowledged leader in cost-effectively increasing production from mature oil and gas fields and accessing hard-to-reach reserves by applying advanced technology such as 3-D reservoir visualization, geosteered horizontal drilling and enhanced oil recovery methods. We consistently replenish and expand reserves through strategic acquisitions, enhanced oil recovery and exploration.³⁴

³³ (Oxy, 2010)

³⁴ (Oxy, 2010)

Oxy's 2009 year-end press release announced that at the end of 2009, the company's preliminary worldwide proved reserves totaled 3.23 billion barrels of oil equivalent (BOE) compared to 2.98 billion BOE at the end of 2008.

In 2009, the company had proved reserve additions from all sources of 483 million BOE, compared to production of 235 million BOE, for a production replacement ratio of 206 percent. They replaced 206 percent of 2009 production largely through improved recovery and extensions and discoveries. Of the total reserve changes, improved recovery, which reflects the company's enhanced oil recovery activities, represented 173 million BOE of proved reserves additions, mainly in California, Permian and Oman, through the Mukhaizna project.

Over the last three years, they have replaced 160 percent of production. Their finding and development costs in 2009 were \$7.90 per BOE. For the last three-year period, their finding and development costs averaged about \$15.10 per barrel.

For the three-year period 2007 through 2009, Occidental's proved reserve additions totaled 1.1 billion BOE, and total production equaled 663 million BOE, for a reserve replacement ratio of 160 percent. Total costs incurred during this three-year period were \$16 billion.

Our extensive use of enhanced oil recovery (EOR) techniques to extend and maximize production from mature fields also benefits the environment. Recovering oil from existing fields requires significantly fewer resources than installing new infrastructure and equipment at new locations. Furthermore, as noted in the special section on climate change, EOR can be a means of permanent geologic storage of carbon dioxide with the potential to significantly reduce greenhouse gas emissions.³⁵

³⁵ (Oxy, 2010)

In June 2008, Oxy provided Congressional testimony at the request of the U.S. House Committee on Natural Resources Subcommittee on Energy and Mineral Resources, whose members sought Oxy's expertise on carbon dioxide EOR technology.

Sustainable development-based differentiation

Some oil & gas companies studied are differentiating themselves on more evolved sustainability strategies such as:

- Three-dimensional, economic performance, social contribution, and environmental excellence based sustainable development
- Inclusion in Dow Jones Sustainability Indexes
- Participation in the United Nations Global Compact
- Participation in Voluntary Principles on Security and Human Rights Plenary Group
- Participation in Carbon Disclosure Project (CDP)

For example, Woodside has 10 principles of sustainability embedded in the Woodside Management Framework³⁶ (Figure 4). Woodside defines three dimensions of sustainable development: economic performance, social contribution and environmental excellence. Their 10 principles translate into actions across each of these³⁷ (Figure 5).

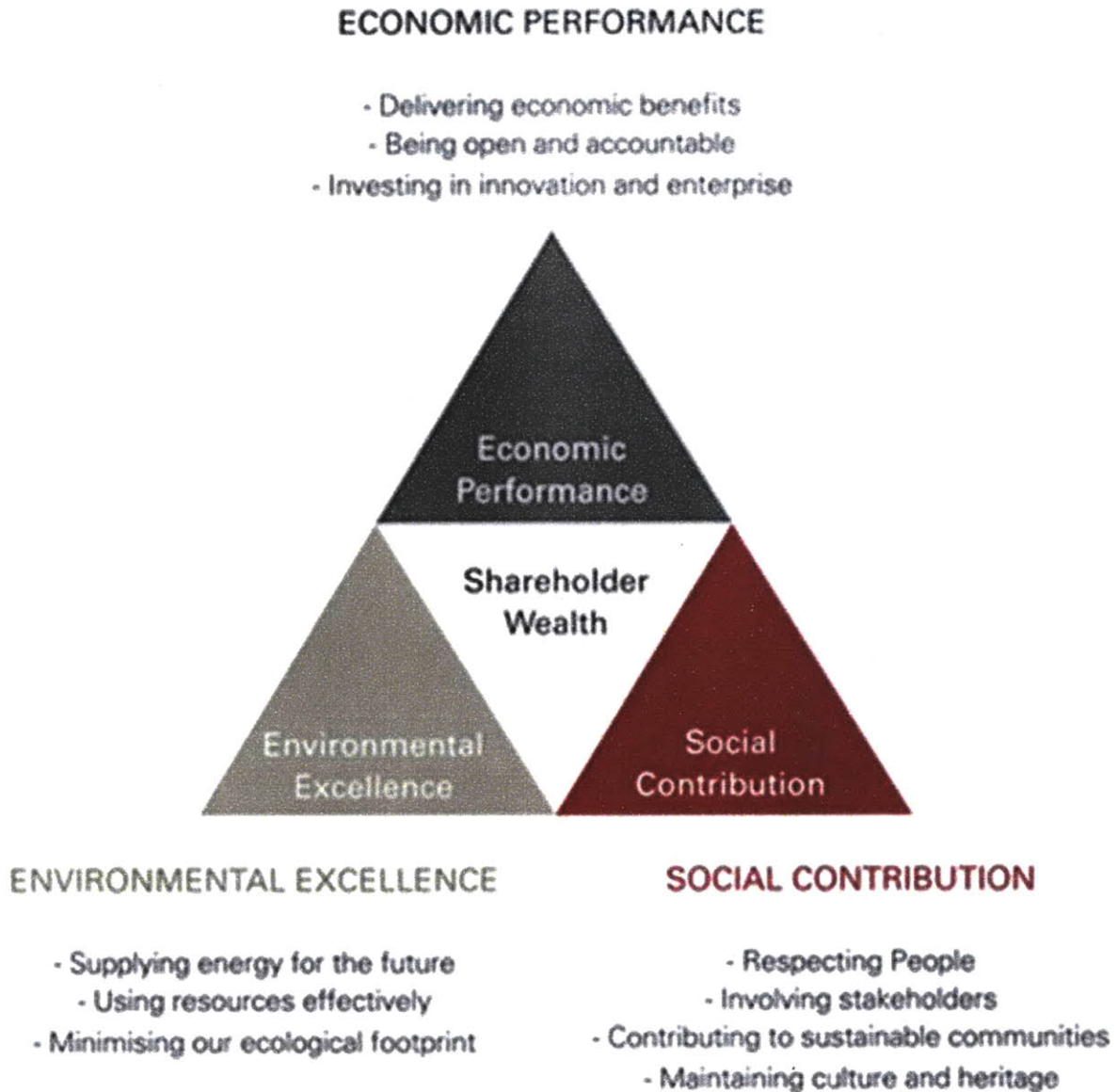
³⁶ (woodside, 2010)

³⁷ (woodside, 2010)

Figure 4: Woodside's Economic Performance, Environmental Excellence, Social Contribution Sustainability Matrix

Sustainability	Performance measure	2008	2007
Economic Performance	Production (MMboe)	81.3	70.6
	Sales revenue (\$ million)	5,990	3,841
	Operating cashflow (after tax) (\$ million)	3,784	2,482
	Net profit after tax (\$ million)	1,786	1,030
	Economic return to Australia (% Woodside expenditure)	74.7	61.9
	Corporate taxes paid to Australia (% Woodside expenditure)	10.89	11.49
Environmental Excellence	Greenhouse gas emissions (Woodside-operated) (tonnes)	7,714,036	7,354,273
	Greenhouse gas intensity (Woodside-operated) (tonnes)	0.23	0.24
	Total flared gas (Woodside-operated) (tonnes)	309,741	297,509
	Significant incidents	21 [⊗]	20
	Fines and prosecutions	0 [⊗]	1
Social Contribution	Health and Safety		
	Fatalities	0	1
	Occupational illnesses	23	24
	Total recordable injury case frequency rate	4.3	4.1
	Lost workday case frequency rate	0.9	0.8
	High potential incident frequency rate	1.1	1.3
	Improvement notices issued by regulator	1	2
	People		
	Indigenous employment - Woodside	44 [⊗]	29
	Indigenous employment - Contractors	124 [⊗]	74
	Graduate program	139 [⊗]	134
	Trainee and apprentice program	101 [⊗]	81
	Reports under whistleblower policy	6	2
	Community		
	Community investment	~\$10 million [⊗]	~\$7.6 million
Indigenous business service providers	5 [⊗]	3	

Figure 5: Woodside's three dimensions of sustainable development



Talisman is included in the Dow Jones Sustainability (North America) Index. The Dow Jones Sustainability North America Index is one of several Dow Jones Indexes that tracks the sustainability performance of companies in a variety of sectors. The annual reviews are based on a thorough analysis of corporate economic, environmental and social performance, assessing issues such as corporate governance, risk management, branding,

climate change, supply chain standards and labor practices. The Dow Jones Sustainability North America Index identifies the top 20% of the 600 largest North American companies listed on the Dow Jones Sustainability World Index and includes more than 100 economic, environmental and social criteria. Talisman is also a participant in the United Nations Global Compact and included in the Jantzi Social Index³⁸.

The Jantzi Social Index[®] (JSI[®]), is a socially screened, market capitalization-weighted common stock index modeled on the S&P/TSX 60. The JSI was launched in January 2006 with partners Dow Jones Indexes and State Street Global Advisors. The JSI includes 60 Canadian companies that pass a set of broadly-based environmental, social and governance screens³⁹.

³⁸ (TALISMAN ENERGY, 2010)

³⁹ (TALISMAN ENERGY, 2010)

Framework for mapping core Exploration & Production (E&P) strategies of Oil & Gas companies

In the following section, we will develop a framework for mapping the core exploration and production strategies of oil & gas companies. Based on our analysis in the previous sections we demonstrate that the traditional core E&P strategies can be mapped on a 3-dimensional framework. The 3-dimensional framework includes:

- Portfolio Management (PM)
- Operational Efficiency (OE)
- Financial Management (FM)

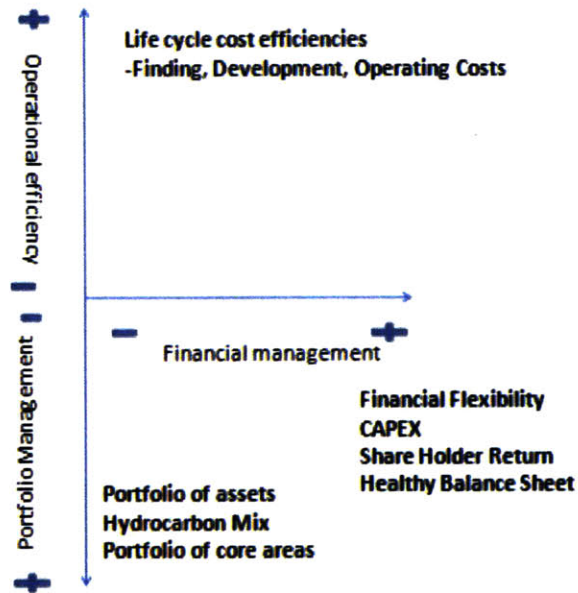
Companies can be characterized on the Portfolio Management (PM) dimension based on the quality of their portfolio of assets, hydrocarbon mix, and quality of their portfolio of core areas.

Companies can be characterized on the Operational Efficiency (OE) dimension based on their life cycle cost efficiencies such as finding, development and operational costs, & their success in adding reserves & increasing production.

Companies can be characterized on the Financial Management (FM) dimension based on their financial flexibility, capital expenses (CAPEX), shareholder returns, and healthy balance sheet. Refer figure PM-OE-FM 3-dimensional framework.

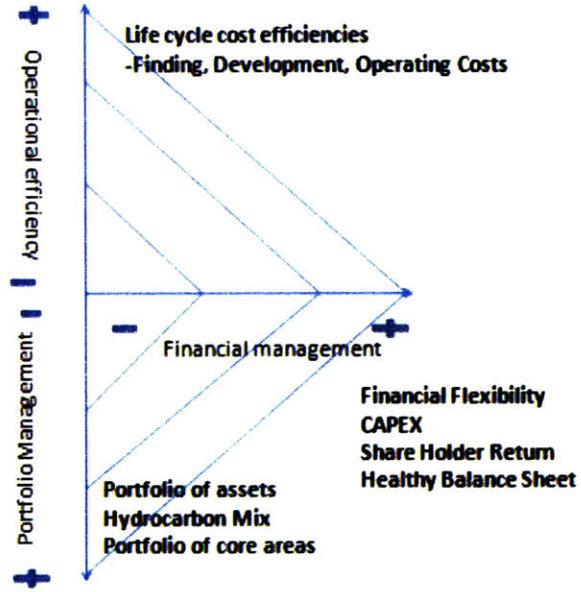
PM, OE, and FM strategies of companies can be mapped on the 3-dimensional framework per the characterizations defined above. This framework is useful in comparing companies on their core strategies:

Figure 6: PM-OE-FM 3-dimensional framework



As discussed in the previous section the PM, OE and FM dimensions are closely interlinked. The PM, OE and FM strategies of companies can be characterized from low, medium, to high. These three strategies determine a company's financial results. On the diagram, a bigger triangle reflects better financial results than a smaller triangle (Figure 7).

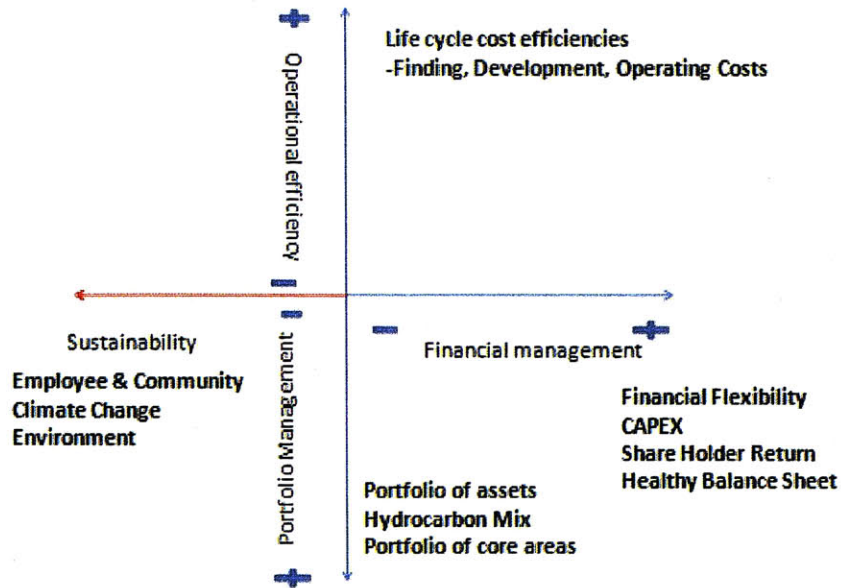
Figure 7: The Traditional Operating triangle



Sustainability the 4th dimension on the PM-OE-FM framework

Sustainability is the 4th dimension on the traditional PM-OE-FM framework and currently not incorporated with the core dimensions (Figure 8).

Figure 8: The PM-OE-FM and S framework

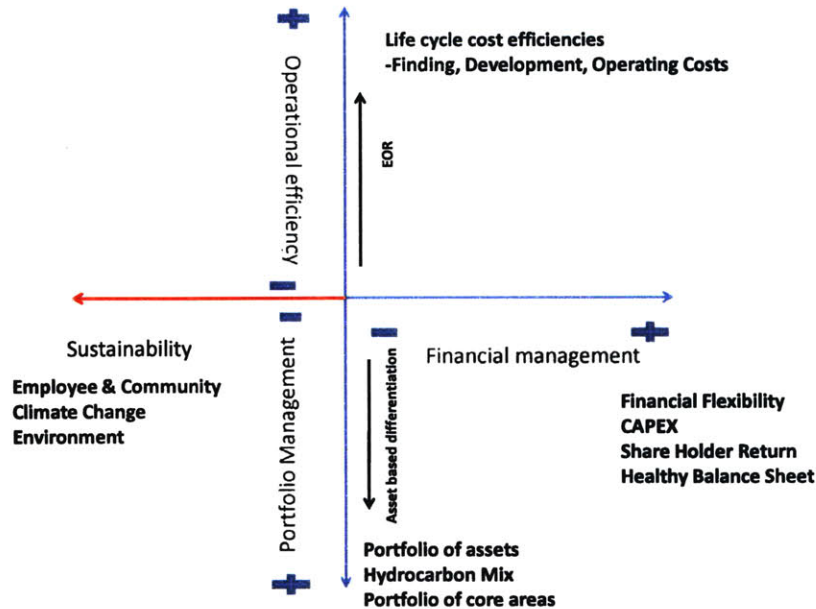


The sustainability strategies do not create value in the operating triangle and currently there are no demonstrated synergies between PM-OE-FM and S.

Unique differentiating strategies in the PM-OE-FM and S framework

Asset-based differentiation enhances the PM dimension on the PM-OE-FM framework, whereas EOR differentiation enhances OE dimension on the framework. These unique differentiating strategies create synergies with the core portfolio management, operational efficiency and financial management strategies by enhancing one or more of them.

Figure 9: Enhanced PM-OE-FM framework



Based on the study of the current industry landscape it is not clear how sustainability-based differentiation enhances core strategies. Intuitively, based on the current PM-OE-FM profitability driven business model, sustainability strategies put a negative (-Ve) pressure on operational efficiency, i.e. reduction in costs.

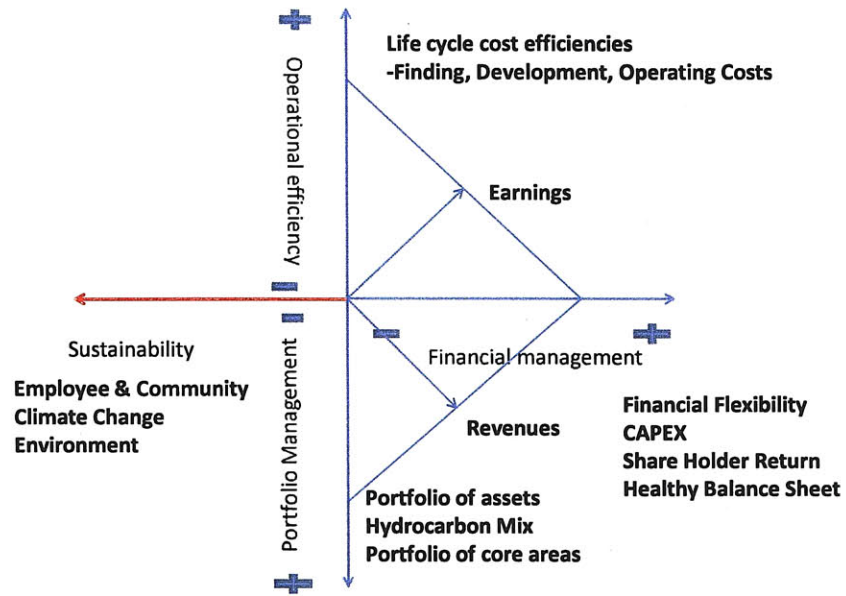
Strategies for most companies studied fall under:

- Medium to High Level of Portfolio Management (PM) Strategies
- Medium to High Level of Operational Efficiency Strategies
- Medium to High Level of Financial Management Strategies
- Low Levels of Sustainability Strategies

Better financial results signify a bigger triangle or better core PM-OE-FM strategies.

The PM-FM Quadrant represents revenues, whereas the OE-FM quadrant represents earnings (Figure 10).

Figure 10: PM-OE-FM and S framework with revenues and earnings



Drivers for change

In this section we analyze how a variety of energy industry challenges can threaten the industry profitability based on the current industry strategies. These challenges are:

- Access to reserves decreasing
 - Continued increase in power of resource owners
- Fields declining
 - Legacy easier to produce giant onshore and shallow offshore fields declining
- Newer fields with easier access pose significant innovation challenges
 - Ultra Deepwater
 - Deepwater
 - Unconventional Hydrocarbons, etc.
- More stringent regulatory, social, and political landscape
 - New Energy Policies i.e. carbon pricing
 - Increased Regulations i.e. environmental, social, economic
 - Greater concerns in the society about global warming i.e. GHG emissions etc.
- Supply/Demand Dynamics
 - Continued increase in energy demand

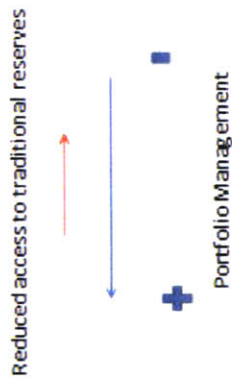
Negative (-Ve) earnings pressures based on the current industry strategies

Access to reserves decreasing

Decreasing access to reserves due to continuing increase in power of the resource owners puts a negative (-Ve) pressure on the industries conventional Portfolio Management (PM) strategies. Decreasing access can result in an unbalanced portfolio of assets increasing both

geological and geographic risks, and an unbalanced mix of hydrocarbons increasing commodity pricing risks etc.

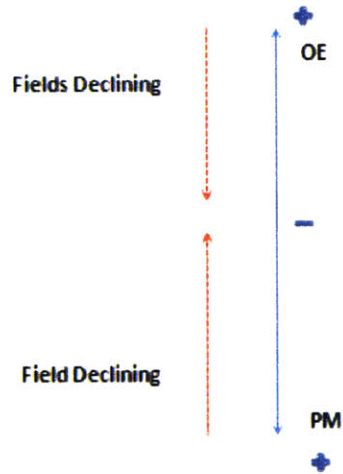
Figure 11: Negative pressure on PM strategies due to reduced access to reserves



Fields declining

Declining fields put a negative (-Ve) pressure on both portfolio management and operational efficiency strategies. The portfolios of core legacy fields that provided a stable asset base and long term growth opportunities are declining. Declining fields result in higher lifting, technical and corporate costs (Figure 12).

Figure 12: Negative pressures on the OE and PM strategies due to fields declining



Innovation challenges posed by easier-to-access, more difficult newer fields in Deepwater, Arctic, Unconventional hydrocarbon etc.

Innovation challenges pose negative (-Ve) pressure on operational efficiency strategies increasing finding and development costs and increasing lifting costs (Figure 13).

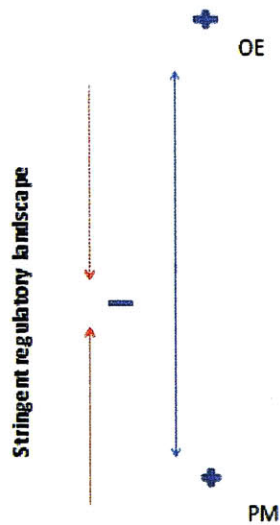
Figure 13: Negative pressures on OE strategies due to innovation challenges



Stringent regulatory, social, and political landscape

The new regulatory landscape puts a negative (-Ve) pressure on operational efficiency and portfolio management strategies by restricting access to sensitive ecosystems, increasing development costs and increasing lifting costs.

Figure 14: Negative pressures on OE and PM strategies due to stringent social, political, and regulatory landscape



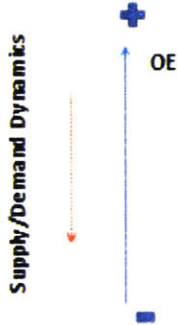
Supply/Demand Dynamics

Continued increase in energy demand puts a negative (-Ve) pressure on operational efficiency strategies due to:

- Increasing finding costs—both organic and inorganic costs
- Increasing development costs
- Increasing lifting costs

In general, there are higher supply side competition and costs due to increased demand.

Figure 15: Negative pressures on OE strategies due to continued increase in energy demand



Decreasing Financial Flexibility

Higher costs and higher capital expenses (CAPEX) both to add and produce reserves will result in decreasing financial flexibility, decrease in the health of the balance sheet (B/S), and lower returns to shareholders.

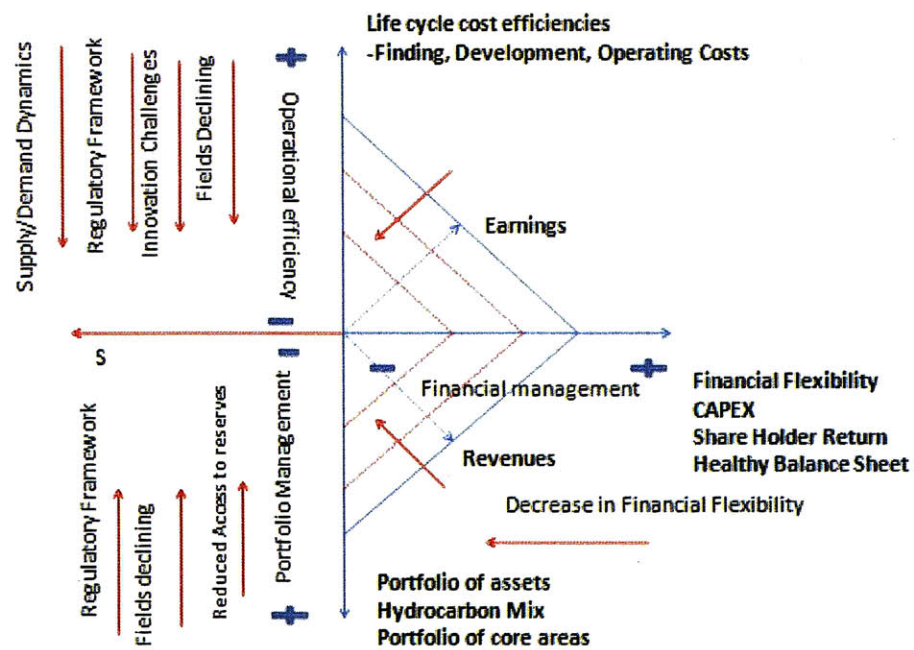
Figure 16: Negative pressures on FM strategies due to decrease in Financial Flexibility



In summary, negative (-Ve) pressure on Portfolio Management, Operational Efficiency, and Financial Management strategies put a negative (-Ve) earning pressure based on the current industry landscape and structure:

- Decreasing Revenues—unbalanced hydrocarbons, lower production
- Decreasing Earnings—higher finding, development and production costs
- Higher capital expenses (CAPEX)
- Lower Free Cash Flows
- Lower Shareholder Returns

Figure 17: Negative pressures on current industry strategies



In spite of increasing investment in exploration and development of reserves, the western majors have struggled to increase crude oil proven reserves and to grow crude oil production. Refer to tables and graphs that follow.

Table 1: Western Majors have struggled to grow their crude oil proven reserves⁴⁰

CAGR, %	2001 to 2008
Rosneft	25.6%
Gazprom Neft	4.9%
Petrobras	2.4%
PetroChina	0.7%
Tatneft	0.4%
Lukoil	(0.2%)
ConocoPhillips	7.5%
BP	3.1%
ExxonMobil	(0.4%)
Chevron	(2.1%)
ENI	(2.2%)
TOTAL	(2.8%)
Royal Dutch	(6.0%)

Table 2: The Western majors have struggled to grow crude oil production⁴¹

CAGR: 2001 - 2008	
Lukoil	3.8%
Rosneft	37.9%
Tatneft	0.9%
Gazprom Neft	7.0%
PetroChina	1.9%
Petrobras	5.0%
Median:	4.4%
CAGR: 2001 - 2008	
ExxonMobil	(0.6%)
Royal Dutch	(3.1%)
BP	3.7%
Chevron	(2.4%)
TOTAL	0.1%
ENI	2.6%
ConocoPhillips	11.3%
Median:	0.1%

⁴⁰ (IHS Herold, 2009)

⁴¹ (IHS Herold, 2009)

Figure 18: Investment in the exploration & development of reserves (2008 NOC Median: \$10.80/boe; IOCs Median: \$15.67/boe)⁴²

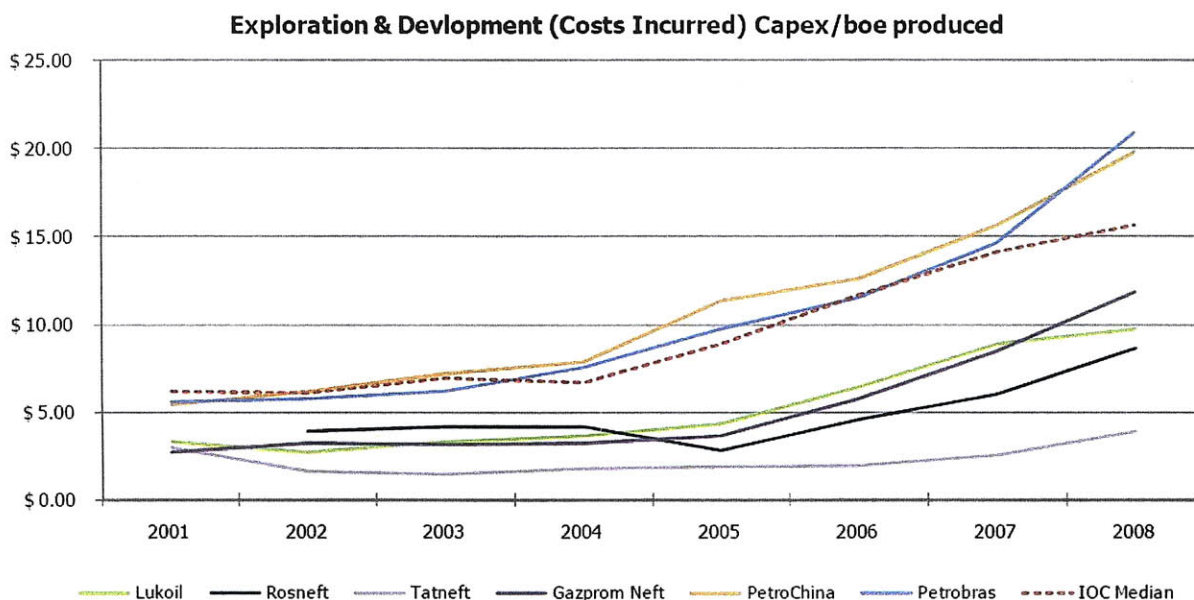


Table 3: Growth in Exploration & Development spending per boe⁴³

CAGR: 2001 - 2008	
Lukoil	17%
Rosneft	14%
Tatneft	4%
Gazprom Neft	23%
PetroChina	20%
Petrobras	21%
Median:	18%
CAGR: 2001 - 2008	
ExxonMobil	13%
Royal Dutch	23%
BP	9%
Chevron	18%
TOTAL	15%
ENI	16%
ConocoPhillips	12%
Median:	15%

The graphs and figures further illustrate that there are negative pressures on traditional PM and OE strategies to add reserves and increase production costs effectively.

⁴² (IHS Herold, 2009)

⁴³ (IHS Herold, 2009)

Strategies to remain competitive

In the previous sections we analyzed how a variety of energy industry challenges are threatening industry profitability. We also illustrated how negative (-Ve) pressures on portfolio management, operational efficiency, and financial management strategies put a negative (-Ve) earnings pressure.

The New Strategic Options

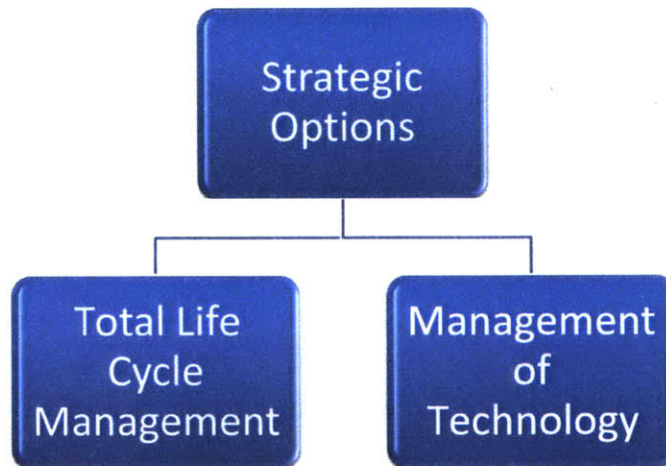
In the following section we outline the new strategic options for oil & gas companies to remain competitive by countering these negative earning pressures on the traditional PM, OE, and FM Strategies. We propose strategies that will integrate sustainability, innovation and technology management strategies with the core PM, OE, and FM operating triangle to create long-term value and profitability for the oil & gas companies. These new strategic options will allow the companies to remain competitive in the face of the energy industry challenges.

Based on an understanding of the threat to the industry structure, current industry landscape and drivers for change we propose two distinct strategic options for the oil & gas companies to remain competitive:

- **Total Life Cycle Management (TLCM)**
- **Management of Technology (MOT)**

Both of these new strategic options build on current industry-wide non-differentiating and differentiating strategies. Environmental aspects are an important element of each strategy.

Figure 19: The New Strategic Options to counter challenges for the energy industry

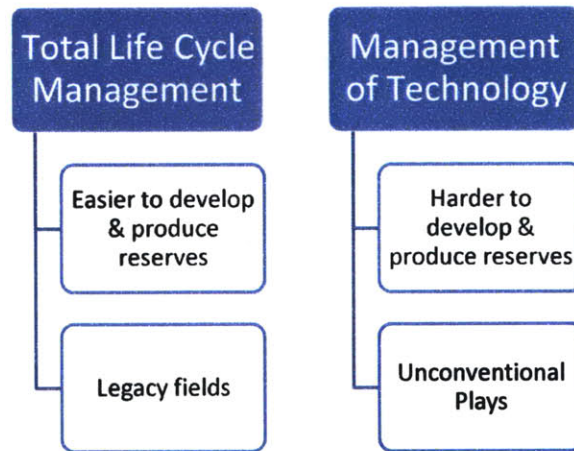


The new strategic options are developed to take advantage of different portfolios. These strategic options build on industry capabilities. Both of these strategic options need different organizational capabilities and thus organizational efficiency will be an integral component of both strategic options.

Target Portfolios for Strategic Options

Both strategic options target different portfolios. Total Life Cycle Management Strategies are more appropriate for developing and producing reserves in known prolific basins such as Middle East, Far East, Russia, Africa, and South America; as well as mature legacy fields such as Alaska, North Sea, and North America. Management of Technology Strategies target harder to develop and produce reserves such as Deepwater, Arctic, etc.; and Unconventional Plays such as Heavy Oil, Shale Gas, Tight Gas etc.

Figure 20: Target Portfolios for Strategic Options



Total Life Cycle Management Strategies

TLCM strategies strengthen and realign core traditional strategies of Portfolio Management (PM), Operational Efficiency (OE), Financial Management (FM) and Sustainability (S) to gain long-term continued access to reserves—as well as to cost-effectively find, develop and produce the target portfolio of traditional fields in known prolific basins and legacy mature fields. Some of the core challenges that the Total Life Cycle Management Strategies hope to address through a life cycle management approach are:

- Access to reserves is becoming increasingly difficult—especially of the target portfolio of easier to find, develop and produce prolific basins
 - Onerous contractual terms with host countries and National Oil Companies (NOCs)
 - Dominance by NOCs
 - Increasing regulatory requirements
 - Increasing societal and sustainable developmental requirements
- Legacy/mature fields declining

Challenges can be primarily classified under access, efficiency, costs and societal development requirements. Through a TLM approach, the companies strengthen and realign their core strategies to address these challenges in unison.

Key components of the Total Life Cycle Management Strategy

Key components of the TLM strategy include:

- Strengthening and realigning
 - Traditional Portfolio Management (PM) Strategies with Relational Strategies for host regions, countries, and communities
 - Traditional Operational Efficiency Strategies with strategies for improving Ultimate Recovery of fields, improving Energy Efficiency of operations, and reducing Carbon Footprint of operations
 - Traditional Sustainable Development Strategies with strategies for reducing Overall Environmental Footprint of operations, providing options for a Hybrid Energy Portfolio to host communities and providing Total Energy Efficiency Solutions to communities
- Develop strategies for improving Organizational Efficiency (OrgEff):
 - Strategies for Organizational Design to manage the Life Cycle
 - Strategies for Local Content Management
 - Increasing Local Suppliers
 - Increasing Local Staff
 - Technical and vocational training for local communities

Five-dimensional strategic framework for Total Life Cycle Management Strategies

Operational Efficiency (OE)

- Streamline Processes
- Repeatability
- Energy Efficiency
- Reduction of Carbon Footprint
- Improve Ultimate Recovery from Fields

Portfolio Management (PM)

- Relational Strategies with hosts
- Balanced Portfolio of Assets
- Balanced Mix of Hydrocarbons
- Portfolio of core areas
- Critical Mass in each of the producing regions

Sustainable Development

- Environmental footprint
 - Reduce physical footprint with newer technologies and more efficient developmental schemes
 - Limit impact of operations and related transportation on air, water and soil quality
 - Develop synergies with alternate energy power sources

- Development of hosts communities
 - Increase local content in suppliers
 - Increase local content in finding, development and operations
 - Training and employment
 - Continuous education
- Hybrid energy portfolio to hosts communities
- Community energy efficiency

Organizational Efficiency

- Organizational Design to develop and implement the *Total Life Cycle Management*

Approach

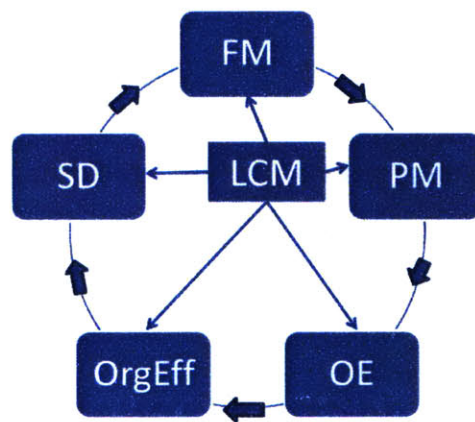
- For Adaptation: Region, country, basin specific
 - Local staff
 - Local content in operations
- For efficiency, and repeatability – improve productivity
 - Vocational & technical training
- For costs efficiencies
- For production optimization— increase ultimate recovery
- For becoming a Total Energy Services Provider

Financial Management to Manage the Total Life Cycle

- Prioritize capital expenses to sustain and grow in a region, country, or basin
- Investments in synergistic projects
- Capital allocation to build scale – ‘Aggregation’

This strategic option will create value throughout the life cycle of the field from: access; efficient recovery; low costs; environmental stewardship; adaptation; organizational efficiency; energy stewardship; renewals of access; community support. This will create overall long-term value by capturing the market share and providing total energy societal solutions.

Figure 21: Total Life Cycle Management



Management of Technology Strategy

The Management of Technology strategy encompasses innovation, technology, project management and operations strategies to economically find, develop and produce the target portfolio of harder to develop reserves and unconventional plays. Some of the core

challenges that the MOT strategies hope to address are the innovation challenges to tap the next big reserves/fields such as Deepwater/Subsea, Unconventional Hydrocarbons, etc.

Current industry challenges with innovation can be broadly classified under:

- Lack of clear innovation and technology strategies
- Insufficient focus on Research and Development
- Project management drives management of technology and not vice versa
- Management of technology not seen as a competitive advantage

However, with access to reserves decreasing and newer fields with easier access posing significant innovation challenges, MOT strategies will provide:

- Differentiation on capability to better identify, develop, and deploy technologies
- Help to address business challenges related to respective key strategic areas of interests and domain of operation such as deepwater, frozen Arctic, unconventional hydrocarbons or enhanced oil recovery

Key Components of the Management of Technology Strategy

Key components of MOT Strategy include:

R&D Strategy

- Exploration and sensing networks
- Innovation Fronts such as Deepwater Developments, Unconventional Shale Gas, Unconventional Heavy oil, etc.

Organizational Efficiency

- Program management to manage the innovation fronts
- Project management to manage a project within a specific program
- Develop synergies between programs and between projects

- Standardization within the programs & projects

Operational Performance

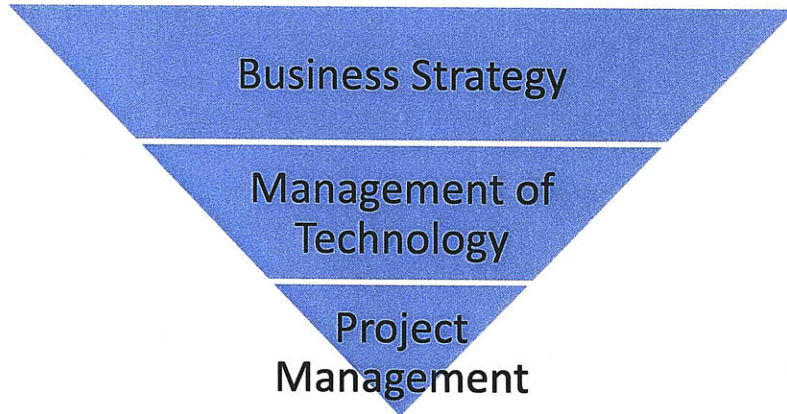
- Design constraints, optimization of developmental schemes
- Costs management, projects delivered on budgeted costs
- Schedule management, project delivered on schedule
- Energy efficiency and environmental footprint

Figure 22: Key Components of Management of Technology



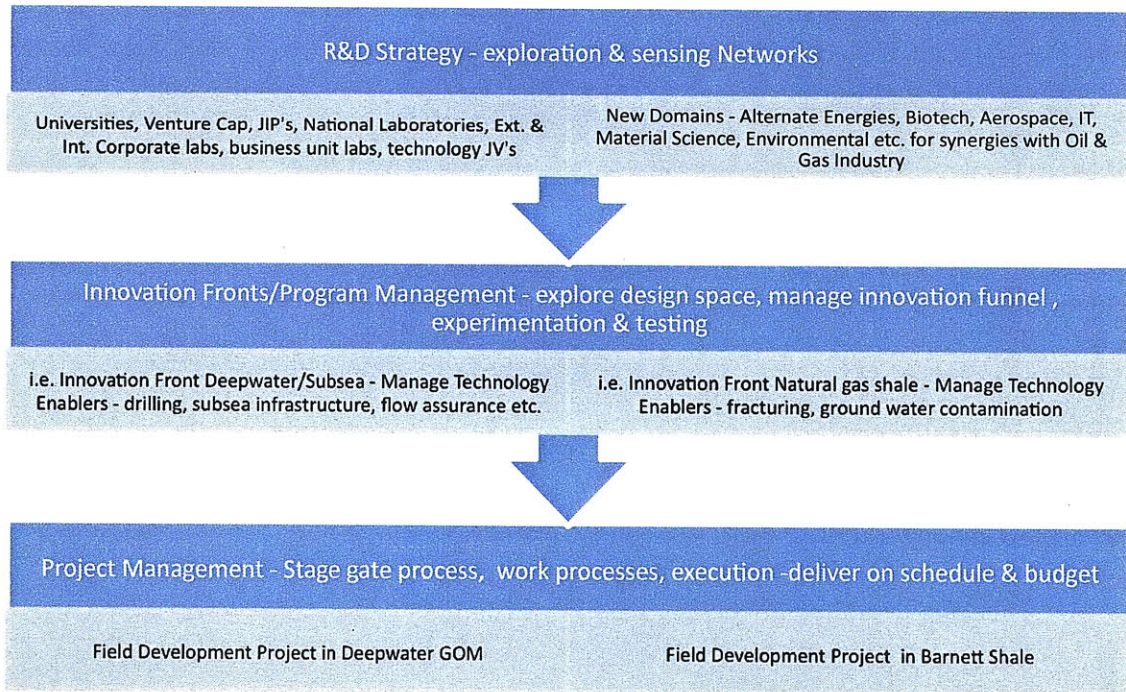
Business strategies of the company will drive the management of technology strategies, and project management.

Figure 23: Business Strategy → Management of Technology → Project Management



Currently the norm in the industry is for project management to drive management of technology, which not only creates organizational inefficiencies but also influences operational performance. Concerted Research and Development to Project Management Strategies will be required for innovative, efficient and effective development of hard to produce reserves.

Figure 24: R&D → Technology Management → Project Management



Management of Technology strategies will create overall value by economic development of hard to produce reserves through; R&D; Innovation; Competitive access to hard to produce reserves; project management; organizational efficiency; global deployment & integration.

The New Strategic Positioning

Based on the proposed 'New Strategic Options' the oil & gas companies can position themselves as the:

- Service Company, Total Energy Solutions Provider
 - Costs and efficiency driven
- Technology-driven with management of big complex projects, big budgets and tight schedule
 - -Management of risks

Organizational Design

The companies can position themselves for both the strategic options only if managed by two different organizations within one company.

Organizational designs for the two strategic options proposed are very different. Total Life Cycle Management will require an organization that is lean and driven by cost efficiencies. An organization that is continually focused on reducing costs by business process innovation. It will also require an organization that is adaptive to local needs.

The Management of Technology strategy option will require an organization culture driven by innovation. It will require an organization that is capable of following R&D, innovation, development and deployment of technologies, and project management on a global scale.

Performance Metrics of Oil & Gas Companies

In the following section we review the traditional performance metrics of oil & gas companies. According to IHS Herold Inc.,⁴⁴ five attributes of successful oil companies include:

- Producing and upgrading heavy oil
- Drilling in deepwater and operating in hostile environments
- Producing natural gas from low permeability reservoirs
- Monetizing stranded gas
- Superior project execution capabilities

IHS Herold, an IHS Company, is an independent research firm that specializes in the analysis of companies, transactions, and trends in the global energy industry. Herold serves a global client base with in-depth analyses and key financial and operational data on the valuation, performance, and strategy of more than 400 oil and gas companies.

Oil Company Valuation

Herold's stock selection process for oil & gas companies is based on:

- Valuation—Understand Why Value Is Changing
- Observe Regional Differences
- Observe Historical Patterns
- Group Discussion Of News Flow

Per Herold,⁴⁵ upstream assets form the primary valuation foundation of oil & gas companies. The efficient cost production of these assets generates superior cash flows

⁴⁴ (IHS Herold, 2010)

⁴⁵ (IHS Herold, 2009)

which in turn drive company valuations. In summary, greater production of resources leads to greater cash flows, which lead to higher company valuations.

The predominant view in the industry and among the analysts is that value depends solely on the ability to cost-effectively produce resources, as argued for example, by IHS Herold. Attributes of successful companies says nothing about:

- Innovative relational strategies with hosts for access to reserves and renewal of access
- Differentiation based on increasing ultimate recovery from fields
- Improving energy efficiency and carbon footprint in operations
- Reducing environmental footprint of operations
- Development of regional or in-country local content in operations
- Organizational efficiency for business process innovation
- Management of R&D, innovation and technology to produce hard-to-develop reserves
- Organizational efficiency for management of innovation

As with the traditional PM, OE and FM strategies, the performance metrics used by the industry and analysts to evaluate the performance of oil & gas companies are traditional and do not reflect the company performance *vis a vis* the variety of energy industry challenges. The industry will need performance metrics in line with the new strategic options discussed in the previous sections. New performance metrics is outside the scope of this thesis and will form the basis for future work.

Conclusions

Energy industry faces a multitude of challenges. Declining fields, constraints in access to reserves, innovation and technology challenges posed by hard-to-produce reserves, new energy policies and supply/demand dynamics are threatening the basic industry structure, and the overall attractiveness of the industry is low.

Oil & gas companies champion four common industry-wide strategies. These are:

- Portfolio Management (PM)
- Operational Efficiency (OE)
- Financial Management (FM)
- Sustainability (S)

Portfolio Management (PM), Operational Efficiency (OE) and Financial Management (FM) are the core traditional strategies of oil & gas companies, and the companies derive their profitability, growth, and shareholder returns based on the execution of these strategies. Superior portfolio management, operational efficiency, and financial management result in better financial results such as higher revenues, earnings and free cash flows.

Sustainability strategies are no longer a differentiating factor. To at least talk about sustainability is a business imperative than a choice. The sustainability strategies of oil & gas companies are not integrated with the core Portfolio Management, Operational Efficiency, and Financial Management strategies.

Some companies are also seeking to differentiate themselves on strategies such as:

- Asset based leadership
- Enhanced Oil Recovery (EOR)

- Development of hard-to-produce reserves, such as ultra-deep offshore resources, high-pressure/ high-temperature fields, sour gas etc.
- Evolved sustainability strategies

These differentiating strategies except for evolved sustainability strategies enhance the core. Currently it is not obvious how sustainability-based differentiation enhances core strategies.

The three-dimensional PM-OE-FM framework allows comparison of companies on their core strategies with a larger operating triangle on the framework signifying potential for better financial results.

We propose two distinct strategic options in face of the energy industry challenges threatening industry profitability:

- Total Life Cycle Management (TLCM)
- Management of Technology (MOT)

Both strategic options build on current industry strategies. Environmental aspects and organizational efficiency are an important element of each strategy.

TLCM strategies strengthen and realign core traditional strategies of Portfolio Management (PM), Operational Efficiency (OE), Financial Management (FM) and Sustainability (S) in order to gain long term continued access to reserves, and to cost-effectively find, develop and produce the target portfolio of traditional fields in known prolific basins and legacy mature fields. TLCM strategies address challenges of access, efficiency, costs and hosts development requirements. Through a TLCM approach the companies address these challenges in unison.

Management of Technology strategies are the innovation, technology, project management and operations strategies to economically find, develop and produce the target portfolio of harder to develop reserves and unconventional plays. MOT strategies address the innovation challenges to tap the next big reserves/fields, i.e. Deepwater/Subsea, Unconventional Hydrocarbons, etc.

Organizational designs for the two strategic options proposed are very different. Total Life Cycle Management requires a lean and cost efficiencies-driven organization, continually focused on reducing costs by business process innovation and adaptive to local needs. Whereas, Management of Technology strategy requires an organization culture driven by innovation, an organization capable of R&D, Innovation, Development and Deployment of technologies and Project Management on a global scale.

Industry and the analysts value oil & gas companies on ability to cost-effectively produce resources. As with the traditional PM, OE and FM strategies, the performance metrics used by the industry and analysts to evaluate the performance of oil & gas companies are traditional and do not reflect the company performance *vis a vis* the variety of energy industry challenges. The industry needs new performance metrics along the lines of the new strategic options of Total Life Cycle Management and Management of Technology.

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